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The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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EDITORIAL

Matter

MR. KINGZETT confesses to being about eighty years of age, an age which does not however greatly impress Prof. H. E. Armstrong who is some years older than that; neither of these ages would have seemed worthy of much note by Dr. Liveing, who was active in the nineties, still less by Chevreul, who was more than a hundred and two years old when he died. To carry a memory of scientific work back for sixty-five or seventy years is quite a considerable feat and we hope that Mr. Kingzett will give us some more reminiscences in the future. He has reviewed in his article "Concerning Matter and Chemical Entities" the progress of those ideas—formerly metaphysical but now chemical—that have undergone so great an evolution from the speculations of Prout to the convincing proofs that have been manifested at Cambridge, chiefly by Rutherford and those he has inspired and assisted. We do not forget the excellent work that has been done elsewhere, but a very ample measure of praise is due to the Cambridge physicists. Mr. Kingzett gives us some interesting notes about views current at a time when masses of hypothesis were being leavened by a few ascertained facts and he gently leads us on to Rutherford's Bakerian Lecture of 1920 and Dr. Chadwick's recent work in the Cavendish Laboratory. Real knowledge on the constitution of matter is so recent that far younger men than Mr. Kingzett can remember the beginnings of it about the year 1894 when Rayleigh and Ramsay here and Becquerel and Röntgen on the Continent began to bore holes through the dark curtains that hid knowledge from us. The work was continued by many workers, the Curies, Soddy, Travers, Thomson, Aston, Barkla, Moseley, Siegbahn, Hevesey, Wilson, Dempster, Chadwick, von Laue, the Braggs. Bohr, Lewis, Langmuir, and many others and above all by Rutherford. It would be a profitable but laborious business to treat historically all the discoveries made since 1894 that have thrown light on to the structure of the atom, and the constitution of matter; the mere bibliography would make a reasonably bulky volume for we have not mentioned by any means all the noteworthy labourers in the field. We have learned much but there is much yet to learn: Prof. C. G. Barkla of Edinburgh wrote last week to *Nature* about the *J*-phenomenon and let the readers of our esteemed contemporary realize that there is a great deal still unknown even about the *K* and *L* phenomena, in the discovery of which five and twenty years ago Prof. Barkla himself played so important a part.

The Infra Red

No photographs in recent years have excelled in general interest some taken by infra-red radiations, whether it be those of the mountains taken from a great distance, or of buildings in a city taken under conditions of fog. So many of us at one time or another have climbed the hills at not a little expenditure of muscular effort to see the view, only to be disappointed by adverse atmospheric conditions, that the revelation by a combination of the telescopic lens and a sensitized emulsion of what we might have seen possesses an especial fascination. In both examples of photography a new eye is at our disposal, able to surmount some of the handicaps to which the human eye is exposed, sensitive in fact to the region from about 7500 Å to 8600 Å, that is, beyond the range of visible light which extends from about 3900 Å at the violet end of the spectrum to about 7600 Å at the extreme red. The process of infra-red photography is not novel, and many workers have been engaged in its scientific application, but it has received a great and practical stimulus by the discovery of a new dye in the Ilford Research Laboratories, which has the merit of making it possible to prepare infra-red emulsions of considerably higher speed than has hitherto been possible. The developments in the subject were discussed recently before the Royal Society of Arts by Mr. O. L. Block, the president of the Royal Photographic Society, who has played no small part in them: his paper will be

printed in the Journal of that Society. Apparently there is much to be learnt about the mechanism of the process, for whereas in general a dye sensitizes an emulsion in the region of its absorption, there is no definite rule that it will do this: for example, such changes as the substitution of a dimethyl for a diethyl group can occasion a great falling off in sensitizing power. The nature of the new dye is not disclosed. The success of infra-red photography depends on the fact that the shorter waves at the blue end of the spectrum are more easily scattered by small particles than the longer waves which make up red light: naturally, the infra-red rays are even less scattered. Actually it has been possible to take aerial photographs of mountains over a distance of 331 miles. When such distances are invoked new factors come into question, such as the size of the water particles which constitute mist or haze, and probably new light will be thrown on this problem. The infra-red photography of the heavens may be expected to supplement the existing methods we have recently discussed. It will be possible with an infra-red filter to record stars which radiate this light whilst cutting off the visible spectrum and reducing the general scattering of the rays on their way to the earth. The new achievement obviously has many potentialities: it is a matter for congratulation that it has been achieved in a British industrial research laboratory.

Contemporary Developments in Science

Under the general title which we have borrowed, a series of lectures by leaders in modern scientific thought and investigation is being delivered at Bedford College, London. The first, which we were recently privileged to attend, was devoted to an exposition of the transmutation of matter by that famous and magically successful alchemist, Lord Rutherford. Speaking with characteristic simplicity and informality, Lord Rutherford told his large audience the fascinating story of the three ways which have been discovered whereby we can disintegrate and synthesize elementary matter, namely by bombardment with alpha-particles, neutrons, or hydrogen atoms. No longer is it necessary to use radium—"the modern philosophers stone: the transmuter and the healer"—as the source of the projectiles, for in Lord Rutherford's laboratory has been developed a method whereby hydrogen particles, discharged and accelerated electrically, may be made available for the purpose in relatively large numbers. Moreover, he has shown that the energy put into such rearrangement of the units of which atoms are made is but a fraction of that which is developed in the process. It is true that visions of the future which are at once conjured before the mind by this revelation fade all too rapidly before the consideration that a far smaller fraction of the projectiles is effective: nevertheless, we like to think that later generations may find something more permanent in our phantasies. As Sir William Bragg (who was in the chair) remarked, to hear the story of a wonderful achievement from the lips of one who has himself been so long and so closely identified with its realization is a most invigorating experience. Nothing indeed grips like the personal touch, and nothing tells like the human voice. Only those whose duties or whose circumstances keep them distant from the personal stimulus can fully appreciate what such isolation means to the active mind: those more fortunately placed look eagerly forward to the next opportunity. Bedford College is to be congratulated on its noteworthy service to scientific life in London.

Cold

It has been cold. Not so cold of course as those Januaries some hundred and fifty years ago of which Gilbert White has written with such vividness, but sufficiently so as to set us thinking as well as to cause us to increase our clothing. Following Mathews, we should certainly be more scientific in our language and talk of adsorbing clothes at that interphase boundary which the ordinary non-chemist terms the skin. When we arise in the morning we find our clothing dispersed in the surrounding phase. Forces, the true nature of which is unknown but which have always looked to us like muscular effort, and this in its turn, we believe, has something to do with the conversion of glucose into lactic acid, cause the clothing to concentrate at the interphase boundary so that the concentration of clothing there becomes greater than elsewhere in the dressing room. In fact, we are dressed, though colloid theory finds no explanation for the choice of a particular tie. The reaction has a very definite temperature function: the coefficient is probably of the order of twice as much clothing for every ten degrees fall in temperature. Some men absorb more than others and in louder patterns, all women seem to absorb as little as possible: it may well be that there are varying quanta of clothing. But we must not pursue our colloid chemical studies too far, for we want to talk also of sugar, the ideal fuel for cold weather, though the vendors of it seem in ignorance of this fact and always miss their opportunity of advertising it in competition with other specifics at this time of year. In the effort to keep the body temperature at the normal in cold weather, a good deal of extra food has to be burnt up, especially by those older people who largely eschew carbohydrates, and an additional inroad is made on the nitrogenous constituents of the food for this purpose, which even under normal conditions are to some extent combusted. Later-day research with a number of bacteria that derive their energy from the breakdown of sugar into carbon dioxide and lactic acid has proved that in the absence of this sugar they make use of the nitrogenous constituents available, with the production at the same time of noxious or even toxic by-products. Thus, the diphtheria bacillus is harmless when grown in presence of glucose, but produces a toxin when incubated in a sugar-free nutrient broth. The inquiry suggests itself therefore whether similar noxious products may not possibly be formed in our own bodies in cases of sugar starvation in cold weather, so giving rise to some of the inconveniences we experience. It is cold, but our deliberations have shown that it is wisdom to absorb clothes and carbohydrates: who shall dispute after such profound conclusions that the most theoretical researches are not of value in the every-day life of man and woman.

CONCERNING MATTER AND CHEMICAL ENTITIES

By C. T. KINGZETT

I wish to make it clear in the first place that in this short essay I have no intention of discussing in any detail the investigations of recent years concerning physical atomic weights and other allied subjects, but only to take a chemical common-sense survey of the relationships between the natnre of matter and chemical entities.

It was at an early stage of my chemical career and in my nineteenth year of age that I sent to the *Chemical News* (edited by Crookes) a letter published in that journal (Sept. 15, 1871, vol. 24, p. 131) entitled the "Oneness of Matter" from which are culled the following extracts:

"I conceive as possible that all matter—simple or compound (so-called)—is constituted of one element under different molecular forces."—"Thus all the 65 elements so viewed would be the same matter actually, but each under different forces: the forces engaged so *operating as to give to each different properties*."—"On this hypothesis if all forces were withdrawn so *as to leave all the ultimate particles in contact*, matter would be reduced to simplicity."

At that time I had no knowledge *respecting the two* papers published by William Prout, M.D., many years *before* (1815 and 1816), *in the first of which*, dealing with the "relations between the specific gravities of bodies in their gaseous state and the weights of their atoms," he enunciated the hypothesis that all substances are compounded of hydrogen and oxygen. In his second paper he veered to the view that the primordial substance is hydrogen, and the largely accepted understanding of Prout's hypothesis which followed, was that the atomic weights of all the other elementary bodies were multiples of hydrogen considered as one.

Dumas considered this as acceptable subject to the modification that the multiples included 0·5 and possibly 0·25 that of hydrogen, but Stas after very carefully determining a number of atomic weights would have none of it and rejected the hypothesis as a pure illusion. Having regard to the admitted great difficulty of obtaining the elements in an absolutely pure state, his analytical results would appear even then not to justify such a determined condemnation.

The later investigations of Marignac upheld the view taken by Dumas, and in connexion with his own research work he opined that the magnitude of the unit which serves as a common denominator, whatever it might be, did not affect the idea of the unity of matter.

It should be noted that in my letter from which the above quotations are made, matter was viewed not as any one specific chemical unit such as hydrogen possessed of definite, characteristic properties, but always (in the countless forms revealed to us) as a sort of otherwise inert material susceptible to the influence of force—quite a different supposition—all chemical entities being dependent for their individual forms, constitutions, characters, and any numerical relations existing between them, *upon specific and varying controlling force* conditions, or, in other words, relationed unit matter and force.

The constitution of matter and the evolution of the chemical elements were the subject of further communications made by me to the *Chemical News* (Sept. 20, 1872, vol. 26, pp. 138 and 202; 1873, vol. 28, p. 288, and vol. 106, p. 183; see also C.T.J., vol. 71, p. 283).

In one of these (1872) the material identity of ozone and oxygen with their varying properties and those of magnesium borate and boracite respectively, were used as representative examples of essentially identical matter revealed in different constitutional (architectural or structural) forms, while other instances of close relationship between a number of chemical entities were referred to as strengthening the view of the identity of basic matter as revealed under varying force conditions.

In a later one (*Chem. News*, Oct. 11, 1912) on the "Evolution of the Chemical Elements" I raised the question whether certain gases as occluded by metals and subsequently eliminated therefrom, are absolutely identical with the original ones employed and suggested the making of certain experiments on this subject, in which connexion it is significant *to note than in 1922* Paul Anson found that the* properties of hydrogen desorbed from platinum and palladium *are not identical with its normal form*, but that it exhibits a quantum or more of energy during adsorption and "reaches internal equilibrium only after a given period succeeding its desorption." Other instances of activated elements had certainly been long previously well recognized and so it seems to me that the revelation of Soddy's isotopes had really been anticipated by the ascertained facts already related and general knowledge concerning the properties of nascent bodies. Soddy's observations concerning some of the more stable forms of chemical entities and their unstable modifications which exhibit the same general chemical properties, and Aston's further work on the subject of isotopes are more or less familiar to all chemists.

In 1873 Dr. Guyot expressed the view that there is no such thing as an absolute vacuum in nature and viewed the so-called ether as constituting the fourth state and the fourth medium of matter—"the most abundant of the states" (*Phil. Mag.*, vol. 11, p. 405 *et seq.*, and *Chemical News*. March 28, 1873, vol. 27, p. 154). Here it is of interest to note that Crookes at a later date, when dealing with what was then styled "Radiant Matter," pointed out that "according to the best authorities," a bulb (like the one he then exhibited) when exhausted to a millionth of an atmosphere still contained a trillion molecules of matter. (See Fournier d'Albe's "Life of Crookes"; T. Fisher Unwin, Ltd., p. 289.)

In 1878 in a pamphlet on "The Unity of Matter" by Von A. Waldner of Zurich (to which reference was made in the *Chemical News* of Jan. 17, 1879, *vol.* 39, p. 32), the chemical elements are represented as having arisen "*out of the so-called cosmic ether, the one* primitive matter which fills infinite space," and "whose motions make themselves known by the phenomena of light, electricity, and magnetism."

In the same year (1878) in the 6th edition of Miller's "Elements of Chemistry, Part II, Inorganic Chemistry"

* *J.C.S., June, 1922.*

(Longmans, Green & Co.), edited by C. E. Groves, considerable attention was paid to Prout's hypothesis, also to the relations between the atomic weights of the chemical elements and the periodic law which was first enumerated by Newlands and later elaborated by Mendeléeff. (See Newlands' little book "On the Discovery of the Periodic Law and on the Relations among the Atomic Weights," 1884, E. & F. N. Spon. London.)

In 1884 V. H. Veley directed attention (*Chemical News*, 1884, vol. 19, p. 185) to a paper by M. Gerber dealing with certain relations between the atomic weights as affecting Prout's hypothesis and an article on this subject taken from the *Bulletin de la Soc. Chimique* appeared in the *Chemical News*, 1885 (vol. 51, pp. 64 and 66).

In July, 1886, Lothar Meyer and K. Seubert in an article dealing with the atomic weight of silver and Prout's hypothesis, arrived at the conclusion that in its characteristic original conception the latter had been experimentally disposed of and that it was only a philosophical speculation concerning an idea the probable correctness of which would be denied by no one, viz.: the unity of matter. (See "*Berichte der Deutschen Chemischen Gesellschaft,*" XVIII, 1098, or *Chemical News*, 1886, vol. 54, pp. 17—19.)

While engaged in writing this article there has been published by the Alembic Club a small book ("Prout's Hypothesis"—Alembic Club Reprints, No. 20.—Oliver & Boyd, Edinburgh, and Gurney & Jackson, London) on Prout's hypothesis in which are reproduced the two papers written by Prout together with those of J. S. Stas (1860), C. Marignac (1860), and an interesting historical introduction showing among other things that Prout himself anticipated any corresponding idea on the part of Marignac and Dumas concerning the possible existence of substances of atomic weight smaller than that of hydrogen and consequently of a possible smaller unit of comparison. Atteution is also directed in this record to certain other references but no mention is made of my intervening publications bearing on the matter, and others to which I have herein directed attention, a jump being made to the "audacious speculation"—as it has been termed—put forward by Crookes (in 1886) of which more will appear in what follows.

In his address to the Chemical Section of the British Association meeting of 1886 Crookes reviewed the subject in considerable detail, but also omitted reference to these intervening publications. He contended that the balance of evidence showed that "our so-called elements have been evolved from one primordial matter" and he invited chemists to provisionally treat this evolution as if it were a new hypothesis! He made reference to F. W. Clarke's recalculations of the atomic weights and from Clarke's own paper I quote: "Enough has been said to show that none of the seeming exceptions to Prout's law are inexplicable (see *Chemical News*, 1886, vol. 54, pp. 115—126). Alluding to Prout whose later supposition was that hydrogen is the one and only basic matter of the elements, Crookes thought the basic matter was a more primitive and subtle substance, or "formless mist," to which he gave the name of protyle or prothyle, or to use his own words when addressing the Royal Society somewhat later, viz. in 1888, "a state anterior to matter."

Later (in 1890) in his inaugural address to the Institute of Electrical Engineers he dealt again with the suppositional genesis of the elements and their sub-groups (meta-elements) and—apparently adopting the newer idea that chemical molecules consist of electropositive and electronegative atoms—put forward the view that they originally resulted from the actions of "two forms of energy working in time and space dependent upon a continuous fall of temperature and intimately connected with the energy of electricity,"—whatever that might mean.

Again in 1903 in addressing the "Congress of Applied Chemistry at Berlin" he returned to this subject, "Modern Views on Matter: the Realization of a Dream," "comprising the resolution of chemical elements into simpler forms of matter or even refining them altogether away into ethereal vibrations or electrical energy." This quotation is from the "Life of Sir William Crookes" by E. E. Fournier d'Albe, p. 378, to which reference has already been made.

No one could more highly appreciate the brilliant practical work and discoveries of Crookes, but I quite fail to see that his speculations concerning the origin of matter and the evolution of the chemical elements made any advance whatever upon previously expressed views on this subject to which I have directed attention, all of which had been noted or printed in his own journal (*Chemical News*).

On the other hand they complicate the situation for if his hypothetical subtle "formless mist" (protyle) is—as it must be—regarded as a *substance* it was already matter. Otherwise it must be viewed as nothing better than the hypothetical ether of other speculators as to the existence of which there is no evidence whatever forthcoming. One can only conceive the two forms of energy conjectured by him, as exercising their power upon some material substance for without such subject matter how could they act? Further, matter cannot be conceived as admitting of annihilation or transformable into vibrations other than those of derived matter moving in vibrations of wave-like character.

His work on what was then styled "Radiant Matter" and the phenomena exhibited in highly exhausted vessels or greatly attenuated atmospheres proved in course of time to be of great importance as steps towards the more recent physical investigations dealing with atoms, protons, electrons, photons, neutrons, cosmic rays, and emanations, the precise nature of which are still the subject of investigation and speculation and not yet absolutely determined.

Personally I have never believed in the existence of the imaginary ether which certain physicists and mathematicians have used so freely as a base to explain physical phenomena, nor in the purely electrical view of the constitution of matter. This last-named hypothetical conception leaves physicists yet to explain the nature of electricity as also the difference between positive and negative electricity, and it would be interesting to know whether or not they regard magnetism as an isotope of electricity.

I stand now, near the end of my chemical career, where I stood in 1871 as to the "Oneness of Matter,"

viewing it as then expressed, viz.: substance, never existing alone but always in association with force and capable of assuming infinite forms of different characters and properties resulting from the controlling force or forces to which it is exposed.

A block of approximately pure marble when exposed to mechanical power yields a number of pieces of sizes, weights, and shapes varying respectively, according to the intensity of the force used, the bodily structure of the marble and the particular parts of the surface more immediately affected by its incidence: it can also be readily reduced by other operations to a granulated or even very finely divided powdered state. In all these several states the material exhibits contain differences of character and composition varying according to any impurities in the original marble, although substantially the bulk of them are identical. In a similar way the chemical entities known as the elements can by response to other forms of force (suitably exercised), such as heat, light, electricity, alpha rays, etc., be more or less disintegrated, decomposed, or changed into other forms, according to the nature of the environment. Allotropes and isotopes, the activated forms of hydrogen, nitrogen, chlorine, and other gases; the nascent forms of a number of chemical elements are all illustrative of the fact that by the application of sufficiently powerful force, chemical entities admit of a great range of changes.

It is difficult to form clear understandings of the varying views current among physicists concerning the subjects of atomic structure; the electronic hypothesis of chemical interactions; the breaking up of atoms into sub-atoms: the nature of electrons and protons (described as carrying charges or consisting respectively of negative and positive electricity of ultra-microscopical character); neutrons (said to consist of particulate electrons and protons in close juxta-position, indifferent to the strongest electrical and magnetic forces and " too slim to be confined under any pressure in any vessel "—simply " slipping through the walls "); photons (discrete bullets carrying energy and momentum but of certain wave-like properties), etc.

It has been recently reported that working in the Cavendish Laboratory at Cambridge, Dr. Chadwick has shown elementary beryllium (previously credited with one isotopic form) when adequately excited, yields a radiation of great penetrating power, the probable explanation given being that it consists of particles of mass 1 and of zero charge constituting neutrons the existence of which Rutherford predicted in his Bakerian Lecture of 1920. If it be granted that uranium by molecular disintegration gives rise to the production of radium and helium and some peculiar form of lead; that radium itself emits three different types of rays, viz., the *alpha*, the *beta*, and the *gamma*, each possessed of distinctive properties; that *alpha* rays consist of helium and that this element is a very close combination of four hydrogen nuclei and two electrons, and many other surmises of physicists, such conclusions (apart from any paradoxies which they may present) must be taken as strong evidence of the oneness of matter.

I do not propose to venture further into the field of physical observations and speculations concerning the game which has in recent years been played with chemical atoms and not inadequately described by Armstrong (H. E.) as " skittles," but it is of importance to note that all sub-atoms, rays, and emanations are now universally designated as *corpuscular* or *particulate* in character however infinitesimal in size or mass. In other words it may be said that they are either bits of matter knocked off the parent mass or products of chemical change constituting a prodigious series such as isotopes or new substances resulting from the action of externally applied force and relative to the conditions (environment) observed in the experiments.

All these phenomena are easily explicable upon the view expressed in my letter to the *Chemical News* of Sept. 15, 1871, the products in question being so many chemical entities consisting of matter in association with force.

Bearing in mind then that the wave theory of radiation has now become one of corpuscular character, the time has surely come when physical investigation concerning radiations and sub-atomics should be more closely associated with definite qualitative and quantitative chemical investigation. As Crookes once said at a Royal Society meeting (June 18, 1885): " Spectroscopy may give valuable indications but chemistry must after all be the court of final appeal." So it is still, and experiments could and should be made to get to a better understanding of the compositions of the various sub-atomics, rays, and emanations referred to herein. However the atoms of any one substance are held together, they are substantially identical and so it follows that the products of any one disruptive process conducted under the same conditions must be identical also and it is these that have to be identified both qualitatively and quantitatively.

Matter being indestructible in quantity—that is, not admitting of annihilation—the changes in chemical substances brought about by the employment of externally applied force must be attended with relationed re-distributions; and experiments should be devised to ascertain the loss of weight suffered by the parent substances employed and the weights and chemical properties of the residual and derived substances. The corpuscular products, radiations, or emanations should be collected if possible in vessels exhausted of air as far as possible, or streams of them should be gathered up and brought into contact with various chemical reagents in order to gain what information may possibly be afforded by any changes that can be determined. In the meanwhile chemists are entitled to maintain the more materialistic ground, and instead of regarding matter and force as identical in essence and interchangeable, view matter in all its manifold forms from that of highest tenuity to that of the greatest solidity, as the medium or the playmate of force; isotopes, sub-atoms, and radiations being only immensely larger classes of the products resulting from this interplay and always definable as balanced reactions between matter and force.

MAISON DE LA CHIMIE

By W. L. MIDDLETON

The Maison de la Chimie, founded in Paris as a memorial to the French chemist Berthelot, is a highly interesting institution. If certain projects are successful it may indeed be destined to mark a capital advance in the organization of the work of chemists throughout the world. In the home which the French Government has helped to provide it will offer hospitality to conferences and to groups of scientists visiting Paris. But it is proposed to give it more extended functions. It is to be the headquarters of the International Chemical Union, already in activity, and will also house the International Office of Chemistry, which is now being organized. If all important countries join in working the International Office the Maison de la Chimie will thus become a centre of documentation for all classes of European chemical workers, whether purely scientific or industrial.

tion is under the control of an administrative council consisting of representatives of the subscribing countries.

While these general objects are interesting in themselves, the future of the wider scheme will clearly depend on its success in obtaining the co-operation of the communities of chemists in the various countries of Europe who are asked to take part in the work of co-ordinating the separate national activities. The proposal to use the Maison de la Chimie for this large purpose is due to M. Jean Gérard, the Administrator, who seized upon the Berthelot celebrations as an occasion for bringing it forward. The idea of co-ordination is not indeed new. Its real originator was the late Wilhelm Ostwald who actually drew up a scheme for an International Institute of Chemistry as far back as 1912 and tried to obtain the financial support of Solvay for its establishment in the neighbourhood of Brussels. So earnestly did the distinguished German chemist advocate it that the delay in carrying it into effect may probably be counted as one

The "Maison de la Chimie" (street elevation)

of the innumerable checks to intellectual advancement which we owe to the European war. Ostwald's case was that for lack of effective knowledge of the overwhelming output in modern science, much work is quite needlessly done several times over. In the Institute, as he conceived it, "will be executed, once for all, all the labours which repeat themselves always in the same way in the domain of chemical science, and these will be kept at the disposal of everybody." In Ostwald's time there already existed an International Association of Chemical Societies which set up contact between chemists engaged in creative scientific work. His Institute was to supplement that organization by co-ordinating work, especially documentation, which was necessarily a common province of all chemists.

With the contribution of the French Government the amount of money available for the Maison de la Chimie was brought to the total of 37 million francs (about £296,000 at par). Of this nearly £93,500 was subscribed by foreign countries on the occasion of the Berthelot centenary in 1927. The property purchased is the old town house of the Rochefoucauld family in the Rue St. Dominique. It is a fine eighteenth-century building occupying, with its large garden, about an acre of ground in the old aristocratic quarter behind the Chamber of Deputies and the Quai d'Orsay. Two new wings are being added to fit it for its new purpose. The handsome rooms of the main body of the house will be kept to serve as reception and committee rooms. The right wing will contain collections of books and documents, a large reading room and an amphitheatre for lectures and experimental demonstrations. In the left wing will be a conference hall designed to seat a thousand persons, exhibition rooms, and one whole floor placed at the disposal of French groups engaged in specific researches. There will be technical equipment necessary for demonstrations and lantern and film projections, for the reproduction of printed papers, and for the optical examination of documents. The institu-

In the full scheme for which the Maison de la Chimie is designed as the centre it is proposed to carry out the double co-ordination conceived by Ostwald. First, the co-operation in creative scientific work, assured by the International Chemical Union, which in 1919 succeeded to the Association of Chemical Societies. (The Union is on a broader basis than the old Association, since it is made up of Federations of the various national bodies interested in chemistry, whereas the Association included

only one chemical society from each country). Secondly, co-ordination of documentation, for which the International Office of Chemistry has been set up. The Office will take up the task of co-ordination from the moment that a scientific achievement has crystallized in the form of a document.

Events have already shown that the organization of the International Office is the critical feature of the problem which the promoters of the scheme have to face. The Office was created by international convention on the initiative of the French Government. To place the Office on a sufficiently wide basis it is therefore necessary that the Governments of all the principal countries should sign the Convention and engage to pay the annual subscription. For this form of constitution there are of course precedents, among which may be mentioned the International Institute of Agriculture. So far, the Convention has been signed by Russia, some of the smaller European countries, and several South American Republics. Great Britain, Germany, Italy, Spain, Holland, and the Scandinavian countries have not yet officially come into the scheme. It is obvious that the Office could not be effective on the necessary scale with all these countries, some of them of the first importance, left out. In the most favourable circumstances time would be necessary for the progress of a plan which requires at once the good-will of the communities of chemists and the interest of Governments. In the case of Great Britain the scheme encounters the respectable tradition which keeps movements in science and art as far as possible independent of the Government.

With a view, doubtless, to quickening the interest of important countries, as well as fixing certain general notions of what the work of an international organ of documentation ought to be, a meeting of experts was held in Paris on September 19 and 20 last. Prof. P. Dutoit, of the University of Lausanne, presided, and one chemist from each of the following countries was present by personal invitation: Great Britain, Germany, Italy, Spain, Holland, and Belgium. There were also representatives of the International Chemical Union, the International Institute of Intellectual Co-operation, and the International Chamber of Commerce. The British chemist invited was Prof. J. C. Philip, of the Imperial College of Science and Technology, and the German chemist was Herr F. Haber, director of the Kaiser Wilhelm Institut für Physikalische Chemie und Elektrochemie. Although most of those present were acting simply as experts and in their personal capacity, the meeting came to some impressive conclusions. They "considered it highly desirable that the International Office of Chemistry should establish a link, a co-ordination and a permanent co-operation between the various centres existing throughout the world which produce, register, or distribute documentation concerning chemistry in any form." They suggested that the Office should (1) make accessible to all those interested the documentation already existing in the various centres and in collections; (2) direct chemical documentation in course of production into channels facilitating its registration, preservation, and distribution; and (3) assure co-ordination between documentation concerning chemistry and that concerning other branches of scientific knowledge. They urged that the first task should be to make a repertory of centres, to do on a larger scale what the Aslib Directory does for Great Britain. This work has already been taken in hand. It was also considered essential to seek an international agreement which would conciliate authors' rights with the needs of those concerned in the production and distribution of documentation. The experts went into the main details of all these various tasks which the Office will be called upon to perform.

Such is the position at this moment with regard to the establishment and the working of the International Office. It is true that most of the chemist experts were offering advice from outside and that they considered that the Office "will fully carry out its aim when all countries producing documentation have become members." But they recommended the chemists of countries which are not yet members to help the Office in its first steps. In such circumstances the future remains uncertain, but the promoters of the scheme believe that communities of chemists generally will come to recognize its necessity and that the meeting of the experts marks a definite progress. The present effort is directed mainly to organizing Europe, and it may be remarked that Ostwald, in his original scheme, contemplated the establishment of twin Institutes, one in Europe and the other in America.

DU LAIT ET DU FOIE

The horn of the hunter is heard not only on the hill but from competing laboratories everywhere: the hunt is universal after new scents which may figure in the long alphabetical list of advitants. We now have tidings from German packs, one led by eyes looking at livers, the other by scent of B_2. *Berichte* No. 2, issued Feb. 1, to hand this week, contains two most striking, rival preliminary communications, the one dated Jan. 11, the other Jan. 14. Both refer to coloured substances, soluble in water but not in ether, petrol, or benzene, highly fluorescent in aqueous solution, rich in nitrogen and oxygen. The first, by Ellinger and Koschara, on "A new group of animal colouring matters (Lyochromes)," dates from the Pharmacological Institute of the Medical Academy in Düsseldorf; the other from Kuhn, György and Wagner-Jauregg, on "A new class of natural colouring matters," dates from the well-known institutes in Heidelberg: this firm would use the group name *Flavins*. In society, the registration of a birth is obligatory: the name may be given at any time and need not even be registered. The practice might well be followed in chemistry, so that no name be chosen in haste. The E. and K. firm has isolated from milk-whey two beautifully crystalline red to reddish-yellow compounds, obtaining from 10 litres of whey about 8 mg. of crude crystals. The one compound contains C 33·5, H 4·0, N 21·6, the other C 35·7, H 3·3, N 32. Kuhn and Co. have made a more general search. They speak of a product from bullocks' heart containing N 30·0%. Also of *ovoflavin*, from egg albumin, containing N 15·9%; this latter has a high B_2 activity. Spinach, tomato, and yeast

apparently are also sources of these colouring matters. Thus far, the advitants have blushed unseen—only in the ultra-violet: it is encouraging that we may now hope to find some of them wearing colour. Should either of the compounds separated from whey prove to be a B_1 of any sort, a step of great importance will have been taken, as a definite substance that may be estimated will be known, which together with carotene might serve as a guide to quality. At present we have little to help us in gauging the quality of milk, although it is the most important fluid known to man: fat and solids not fat merely tell of the pump, bad food, or ill-breeding. Let us hope that we have no C tragedy enacted over again in the hurry of the hunt. It is a pity that communications cannot be reserved by all parties until definite results and clear issues are established—we need a higher ethical standard in our scientific inquiries. H. E. A.

Dr. R. T. COLGATE

R. T. Colgate was educated at Eastbourne College and at the Central Technical College under Prof. H. E. Armstrong. He stayed on there as lecturer and to do research work, for which he was awarded the Doctorate by the London University. He went to Huntley & Palmers as chief works chemist in the last few days of 1913 and has remained there ever since, rising always higher in the esteem and affection of his directors, his

colleagues on the staff, and the workpeople of that great institution, for it is far more than factory, at Reading. At first sight an uneventful career, but in reality one which would prove to be crowded with incident, difficulties surmounted, new developments initiated, were it only possible to lift the curtain which veils it.

Dr. Colgate, as his friends know, is no mean athlete and excels at cricket, being up to county form. He has the batsman's temperament, being content to wait for the loose ball and send it to its proper place on the boundary. He takes this outlook with him into his daily occupation, and is accordingly a most valuable man to have on a committee. As an organizer he is outstanding, and the social life at the biscuit factory owes much to his labours; for many years he served as the honorary secretary of the Factory Recreation Club and is still deputy-captain of its famous cricket eleven. He has done equally valuable work for the Reading Athletic Club, and there is little wonder that when he contested a difficult seat for the Borough Council he received a very popular majority. On the Council he has been particularly connected with sewage questions, to which he has applied his chemical knowledge to the great advantage of the town. Equally successful has been the application of his learning to the horticultural perfection of the local cricket grounds, and in consequence there can be few provincial towns that have a greater respect for what science can achieve than Reading. His work for our Society, both on its Council and as secretary of the London Section, of the London Conference, and of the last Canadian-American tour, and now as honorary treasurer, has made him known to most of us and brought him many new friends. He has also served the Society of Public Analysts and is a Fellow of the Institute of Chemistry.

We have said but little of his scientific work. His only publications relate to the work done at the Central, but there are those who know that his achievements in this direction during the twenty fruitful years in the biscuit industry amount to an aggregate of which any chemist might be proud. His influence for good in all the circles in which he moves and works is a potent factor in his life.

NOTES FROM HOLLAND

Chemical products to the extent of 311,000,000 kg., valued at 47,000,000 fl. were imported into Holland during 1932, compared with 348,000,000 kg. valued at 59,000,000 fl. in 1931. Exports of chemical products also decreased from 153,000,000 kg. in 1931 to 132,000,000 kg. with a value of 29,000,000 fl. in 1932. Sulphuric acid to the extent of 87,000,000 kg. was imported during the year, and exports included 61,000,000 kg. of dyestuffs.

During 1932 the Dutch East Indies exported 190 tons of iodine.

Dyes which are claimed to be fireproof are being manufactured at Zaandam works of P. Schoen & Son, Ltd., and sold under the trade marks "Tornol" and "Tornulose." The dyes are said to be carried in a material called tornesite, which prevents fire by the smothering effect of the smoke it produces.

A floor-polishing wax which has the advantage of not being slippery, whilst retaining all necessary polishing properties, is being produced by the N.V. Serena Was Fabrieken. This wax has recently been tested by the Rubber Research Board in Holland, and no detrimental effect on a rubber floor has been found after three months' use.

A composition of charcoal and cement is being put forward as a useful building material by D. de Lange of de Bilt and H. J. Nettel of The Hague. The material which has been given the name "Delneton" has valuable insulating properties, similar to cork, and has been shown to be almost unaffected by prolonged alternation of high and low temperatures. It can be sawed, nailed, and drilled without any crumbling.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

Delivery of Journal of February 3.—Will any member or subscriber who has not received his copy of last week's number kindly notify the General Secretary? Influenza claimed the entire staff concerned in distribution and it is known that the emergency team committed some mistakes for which apology is now tendered.

Indexes.—The Index to the JOURNAL and the separate Joint Index to the Abstracts "A" and "B" will be posted to all paid up members and subscribers of 1932, without further application. The Indexes will be completed about April next.

BIRMINGHAM AND MIDLAND SECTION

At a meeting of the Birmingham and Midland Section of the Society held at the Birmingham University on Thursday, February 2, under the chairmanship of Mr. H. W. Rowell, a paper on "The Properties of Molecules as Learned from Surface Films" was read by Dr. N. K. Adam, of the Ramsay Laboratories, University College, London, and Imperial Chemical Industries, Ltd.

It was shown by Pockels, Rayleigh, and Langmuir that many insoluble substances will spread over a clean water surface to form a layer one molecule thick, floating on the water surface and anchored to it by adhesional forces, which are of course identical with the chemical forces of primary or residual valency. Such unimolecular films offer an exceptional opportunity for studying the properties of the molecules in the films.

It has been found that the films exist in several states, which closely resemble the solid, liquid, and gaseous states of matter in three dimensions. The amount of lateral adhesion between the molecules determines whether the films are coherent or composed of molecules moving separately in the surface. The degree of stability of the films depends on the strength of the adhesion to the water, and gives a rough measure of the affinity of the polar groups in the molecule for water.

In many films the molecules are packed closely, side by side, in simple arrangements. Molecules with a long hydrocarbon chain and a single water-soluble group at one end, generally stand upright in the surface with the water-attracting groups downwards, adhering strongly to each other laterally so as to form a compact, coherent film. If the hydrocarbon chains are shorter, the packing often becomes less compact, and probably in such films (called "expanded" films) the hydrocarbon chains are oscillating violently from side to side. If a second water-attracting group is introduced, at a distance from the first, the molecules usually lie down flat and the film ceases to be coherent, but consists of large numbers of molecules swimming about independently in the surface. The properties of the molecules are always those to be expected from solid models made up on the bases of the constitutional formulæ of organic chemistry, and the surface films therefore indicate that these formulæ are an accurate representation of the actual construction and shape of the molecules. The dimensions of molecules found from the films agree well with those ascertained by the analysis of crystals by means of *X*-rays.

Much may be learned from surface films about the constitution of complex molecules such as sterols, vitamin-*D*, and many other compounds whose structures have not yet been fully unravelled by chemical means alone. In fact, where surface films can be formed of sufficient stability to study, the examination of these films, which can be quickly conducted, affords a valuable new means of investigating the constitution of complex substances.

Most of our knowledge of the structure of these films has been gained by studying their behaviour under lateral compression. This gives direct information on the shapes and sizes of molecules, but additional means of investigation are now being employed. The most important of these is the study of the change in electric contact potential at the water-air surface, caused by the presence of the films. This is connected with the distribution of electric moment. Although it appears difficult at present to give a complete interpretation of all the results of measurement of this "surface potential," there is no doubt that it is a valuable new method, and that it gives independent information as to the homogeneity of the films, and also often indicates the orientation of the active, water-soluble groups in the molecules, whereas the old method only indicated the orientation of the whole molecules.

Dr. Morrell said he was extremely interested in the developments of research work which had recently been made, and he felt sure that it could be applied to a great many practical problems. Personally he had had some experience of the value of the results obtained from the methods of those engaged in this kind of research.

Dr. S. R. Carter, of Birmingham University, took part in the brief discussion which followed.

A vote of thanks was passed to Dr. Adam.

GLASGOW SECTION

At a joint meeting of the Glasgow Section with the other chemical societies of Glasgow, held in the Royal Technical College on Friday, February 3, Prof. A. Findlay, M.A., D.Sc., of Aberdeen, delivered an address on "The Appeal of Science to the Community."

The appeal of science, said Prof. Findlay, has most frequently been made on the grounds of the utility of science. Achievements in physical and biological science and in preventive medicine are common knowledge and have all added materially to our comfort and well-being. Efficiency in industry, produced by nearer approach to mechanical perfection, has proved the salvation of some of our industries but may, if carried into action without regard to higher considerations, be productive of great evil to the people and to the country. Efficiency is necessary but it must not be made the ruling force of our civilization lest all the higher values of human life be lost in a ruthless materialism and lust for power. Far finer than all the material progress accredited to science are the idealistic and purely unselfish aims that have prompted all great scientific discoveries. This idealistic spirit is the appeal which should be made by science to the community. The spirit of science is the spirit of truth with which merges the great human values of beauty and goodness. This spirit is not to be found in the mere amassing of facts but in the great

hypotheses and theories of science and is thus entirely of the intellect.

Inculcation of this spirit of science in all classes of the community and especially in the students of arts and letters from whose ranks are drawn our statesmen, is a factor which should influence strongly all our schemes of education.

The claims of certain scientists for a supreme position of power in the government of the country is not supported by the main body of men of science. A scientist, as such, is not fitted to govern since as a specialist in science he lacks that indefinable something, that appreciation of the higher aspirations of man which is so essential to wise legislature. Laws of science cannot be disputed on grounds of personal prejudice but understanding of these laws does not confer a special power to dictate the course of international relationships.

In concluding, Prof. Findlay made a special plea that men of science who have cultivated a rich humanity and have educated their minds to take a wide view and to form balanced judgments, should take a fuller share than they have, perhaps, hitherto done in the common duties of citizenship.

In opening the discussion which followed, Prof. Caven said that he was in complete agreement with all the views of the lecturer. Science had contributed to our material welfare and had increased our leisure. Unfortunately, this had meant for some of our people a period of enforced unemployment. This unemployment was partly the aftermath of war and was partly due to increased efficiency in our industries. Scientists must analyze the whole problem of this tendency and direct its course so that the comfort and economic satisfaction of the whole community shall be assured. For this reason it is necessary to instil into our people a broad outlook and the true spirit of science which includes the three great human values, truth, beauty and goodness.

Mr. MacLaurin said he considered that industry should be more largely controlled by scientific men than it had hitherto been. A great many directorates were composed of men with no practical knowledge of the industry they were running and who frequently did not consider improvements which they did not understand. Politicians were in the same position since a great deal of our knowledge of economics was not based on scientific principles as was witnessed by the great divergence of opinion on Free Trade and Protection. Politicians should be trained to possess a scientific outlook as with this would come a stricter adherence to the truth.

Prof. Findlay, in replying, said that there had arisen a slight misunderstanding. If business men did not understand the workings of their industry then that was bad business. Both in business and in the affairs of the country there must be organization. Science must act with facts but in affairs political it was sometimes difficult to get the facts and even with a knowledge of the facts there was the added difficulty of application which was complicated by differences of opinion. Human nature does not function like a machine but must be considered on higher human values. Russia was an example of efficiency run riot. There, there was a definite plan and society was being run on scientific lines with the subsequent conversion of man into an economic machine. There had been too much misunderstanding of the term science. It was a collecting of facts, arranging these into laws, and then beyond that the formation of theories. These laws can be applied to machine-like objects but not to people who possess a difference of opinion. It seemed that our present troubles had arisen as much from a neglect of ethical values as from a neglect of science.

Dr. Gordon said that he could not add much to the discussion as he was in complete agreement with all that had been said. It seemed to him, however, that it was the function of general education to inculcate the spirit of science and that this education should be completed before any specialised course in science be undertaken. From his experience he had found that what appealed most to the non-scientific public was not the hard facts but the philosophy of science. He also wondered if there was any distinction between the philosophy and the spirit of science.

Prof. Findlay said that he did not consider that there were any shades of distinction between the philosophy and the spirit of science. He considered that from the experience of the Scottish universities a course in scientific training should be included in the Arts curriculum. Such a course need not include any laboratory instruction as this sometimes had the effect of scaring away students. Where a course of laboratory work was possible then it was of undoubted value.

Mr. Jamieson said that recently he had had to consider the matter of parliamentary representation for scientific men. It seemed desirable that there should be a greater number of scientists in Parliament though he admitted that scientists as such were not entitled to a supreme position. He thought that scientists could, by study, understand human nature and would make suitable administrators.

In reply Prof. Findlay said that it was clear that scientists should take a more active part in affairs of government. Whether a scientist should be an M.P. or not was a controversial subject. If our finest investigators entered Parliament they were lost to science and if a rank and file man of science were elected he did not carry enough weight and would only be a cog in a party machine. There was no reason however, why a man of science should not be a successful legislator but he must have a broader outlook than arises from scientific specialization.

Mr. Bruce said that he could not understand any one claiming to be cultured without having had some scientific training. One advantage that would accrue from the presence of scientists in Parliament would be the lack of the present necessity for outside counsel on scientific matters. In science there was international agreement but in economics there was no concordance of opinion. Economics had not attained the status of a science and it was necessary that the best brains of the country be applied to this subject to endeavour to find a means of clearing up the present chaos.

Dr. Cumming spoke of the alarming lack of consideration of human life which was apparent in some industrial

organisations and quoted some cases from his own experience.

Mr. Gunn raised the point of the scientist in industry. He said that the idealism which moved an unfettered scientist was apt to be lost in industrial practice where the cost of improvements bulked so largely.

Dr. Cranston, in proposing a vote of thanks to the lecturer, said that scientists must endeavour to cultivate, apart from their scientific knowledge, that something else which results in a richer and fuller personality. Science is a search after truth. Reality was formerly considered to be its aim but by analysis of matter it had been shown that things were not so tangible as they seemed but were merely vibrations in space. The only real thing left was our own consciousness. Science did not lead us to reality but trained us to regard facts without prejudice and was in itself neither good nor evil. The results of science however, were often misapplied and it was a serious question as to whether science should continue to produce results to be misused. Science had raised us from poverty to superfluous wealth and it seemed possible that, by making a science of economics, the present state of affairs could be rectified. Scientists were not properly balanced unless they possessed a true appreciation of truth and beauty.

LONDON SECTION

There was a good attendance at the meeting of the London Section on February 6, presided over by Dr. G. W. Monier Williams, when a paper on "Hormones" was given by Prof. E. C. Dodds, M.V.O., M.D., Ph.D. In the early part of his paper Prof. Dodds dealt with the history of hormones. Most diseases of animals were attributable to definite causes, such as the destructive effects of disease organisms gaining access to certain organs, and if these causes were not immediately apparent they were revealed in post-morten examination. There were, however, several diseases the symptoms of which could not be explained in this way, and on post-mortem examination these showed pathological features which were not apparently connected, and were incapable of explanation in the ordinary way. In one disease of this type post-mortem examination revealed fibrosis of the thyroid gland, and the removal of the thyroid gland was capable of producing the same symptoms; moreover, when an extract of thyroid gland obtained from monkeys was administered by the mouth to a sufferer from the disease, the symptoms were removed.

The conception of hormones had therefore arisen as substances secreted by such glands as the thyroid, suprarenal, and pituitary, which were necessary for normal health, any deficiency in such a substance leading to disease. Unfortunately, the early work on hormones had led to the belief that such deficiency diseases could be treated by the administration of glandular extracts by way of the mouth, but although this was successful in some cases, it was not always the case, the active principle of the extracts often being destroyed by the digestive juices in the alimentary canal, and being therefore not absorbed into the blood stream. Prof. Dodds illustrated this point by reference to the case of diabetes, which had been connected with deficiency of secretions from the pancreas, and for many years it had been believed that the disease could be treated by the administration by the mouth of pancreatic extract. It had been discovered later that the pancreatic hormone was not absorbed in the alimentary canal, being destroyed by the digestive juices. Similarly the symptoms of "Addison's disease" could be eliminated by intravenous injection of a hormone extracted from the suprarenal bodies, but not by administration by the mouth. The lecturer proceeded to give other examples of the secretion of hormones by various glands in the body, and their connexion with the normal function of various organs. It was possible also for excessive secretion of hormones to give rise to diseases, but these were in the nature of pathological rarities. Hormones, moreover, were not confined to the animal kingdom, and it had been established that they played an important part in plant life. Prof. Dodds instanced recent work at Utrecht in which the heliotropism of the oat shoot had been found to be connected with the presence of the substance known as auxin. The removal of the tip of the shoot, in which the hormone was present, made the shoot fail to respond in the same way to light. Auxin had also been found in the human body, although its function there was not known. Treatment of plants with various hormones caused premature flowering, in the same way that premature puberty of the animal could be brought about by treatment with hormones.

Dealing with the chemistry of hormones, the lecturer stated that they could be grouped in four divisions, (1) Proteins, which were destroyed by enzymes such as pepsin and trypsin, (2) Amino-acid derivatives, such as adrenalin, being capable of absorption in the alimentary tract, (3) Sterols, including many isomers, many of the sex-hormones being of this class, and (4) Various hormones of an unconstitutional class. Prof. Dodds concluded with the remark that a great deal remained to be learned about hormones, and there was a wide field of investigation both for the chemist and the physiologist.

In the discussion which followed Dr. F. H. Carr complimented the speaker on his excellent paper and endorsed his remarks regarding the work which was still to be done. So far our knowledge of hormones was sufficient only to enable us to prepare two of them—adrenalin and thyroxin—synthetically. Moreover, we could not yet distinguish sharply between hormones and many other substances such as the vitamins, or establish the connexion between them. Dr. J. W. Cook, on behalf of the Section, thanked Prof. Dodds for his paper, and drew further attention to auxin, the latest information about which indicated that it contained only carbon, hydrogen and oxygen. It appeared to be of a reduced carotene type which might suggest a connexion with vitamin-*A*. Prof. E. L. Kellaway asked Prof. Dodds if he could state how the control of œstrin was brought about by prolan. Was this an instance of one hormone being produced in response to the action of another? If this were so, which came first in the order of time? Dr. H. E. Cox asked if any information was available to indicate what it was that controlled the functioning of the pituitary gland, and asked if glands were entirely involuntary in a way analogous to that of involuntary muscle. Other speakers

referred to the action of auxin in the vegetable shoot. Mr. T. McLachlan stated that ampoules were advertised to contain mammary, pineal, prostate, and thymus extracts, and asked whether work on hormones was sufficiently advanced for these to be commercial propositions. In replying to the discussion Prof. Dodds said substances such as auxin appeared to be genuine hormones, with definite functions distinct from the vitamins. The cycle of changes connected with the production of œstrin appeared to be dependent on secretion from the pituitary, but there appeared to be nothing to explain the periodicity of functioning of the pituitary. With regard to the involuntary functioning of glands the suprarenal could be stimulated by fright etc., but there was no information as to the control of other secretions. With regard to commercial production he believed the commercial was ahead of the scientific stage. The capabilities of these productions were difficult to prove in the laboratory, and his opinion was that there was little justification for their sale.

MANCHESTER SECTION

A joint meeting of the Section with the Manchester Section of the Institution of Rubber Industry and the Plastics Group of the Society was held at the Engineers' Club, Manchester, on Friday, February 3, under the chairmanship of Dr. W. J. S. Naunton, who was supported by Dr. T. Callan, Dr. R. H. Pickard, F.R.S., Mr. H. V. Potter, and Dr. L. A. Jordan.

Mr. W. H. Nuttall, F.I.C., in discussing "Synthetic Resins and other Plastics from an Electrical Standpoint," stated that the distinction drawn between electrical conductors and insulators was generally of an arbitrary character, even the best insulating materials being conductors to a limited extent. The passage of electricity through an insulator must necessarily be of the same character as through a conductor: it merely differed in degree. In either case it was a passage of electrified particles through the mass of the material. A large number of insulators were complex organic compounds, so that any ionizable matter they might contain must be regarded as an impurity. A very obvious method of improving insulating materials would be the removal, as far as possible, of such ionic impurities. At present very little advance had been made in that direction, with the possible exception of ebonite. The different methods which had been adopted for the improvement of the electrical properties of ebonite were based mainly upon the purification of the rubber used. The protein matter was removed from the rubber latex by treatment with caustic alkali and by careful washing. It was found that the breakdown value of such purified rubber was raised by some 300% to 400%. It was also possible, by the incorporation in ebonite of up to about 10% of a highly-absorbent carbon black, for the general electrical characteristics of the ebonite to be improved by 50%. Apparently the function of the carbon black was to absorb any moisture and electrolytic matter present. It was somewhat difficult to remove such ingredients from dielectrics generally. The small final conduction current was mainly due to electrolytic impurities. The momentary large initial current, known as the charging current, might consist of two components. The first of these was what was known as a displacement of polarization current. As molecules were held together by electrical forces, they tended to become disturbed when subjected to an external electric field. The molecules were put in a state of strain by the displacement of their bound electrons and protons in opposite directions. This displacement was known as polarization, the hitherto neutral molecules becoming induced dipoles. If the voltage increased sufficiently, such displacement might become excessive, eventually bringing about breakdown. A breakdown by dissociation, namely the tearing apart of protons and electrons, might be the cause of the explosive nature of the breakdown of materials such as porcelain and glass, which shatter when subjected to suddenly applied voltage. With organic insulating materials breakdown by dissociation was not likely to occur, as they were usually composed of colloidal masses in which the molecules existed in such a high degree of association that the possibility of dissociation and ionization was reduced to a minimum. The second component of the charging current was that known as the absorption current. This was now generally supposed to owe its origin to the presence of permanent dipole molecules in the dielectric. Permanent dipole molecules were polar molecules possessing a definite hydrostatic moment. They did not tend to line up in the direction of the electric field. This orientation of the dipole molecules was an importaut factor in insulating materials, especially at high voltages, for two reasons. In the first place, electric energy was used up in causing the orientation. This dielectric loss might assume very serious dimensions, especially when dealing with alternating currents at high voltages. A dielectric loss was usually determined indirectly by the power factor, which could be measured quite easily by means of a shearing bridge. Secondly, the energy dissipated by the turning of the molecule against the friction of the medium revealed itself in the form of heat, and unless the heat was dissipated much more quickly than it was produced the breakdown of the dielectric was assured.

SOUTH WALES SECTION

Although illness was responsible for the absence of Mr. A. J. Cruise, the lecturer for the evening, many members, including a number from Pontypridd and Swansea, gathered on January 27 to hear the paper on "The Use of Gaseous Fuel in South Wales Industries." At the invitation of the meeting Mr. T. G. Watts read the paper in the absence of Mr. Cruise.

After briefly surveying the combustion of fuels and the transference of heat, the factors were considered which decided the choice of a fuel for a particular process. There was, firstly, the cost per therm of the fuel itself, and it was essential that this cost be kept as low as possible for economic working. When assessing the operating costs of a process, however, it had to be realized that in many cases the fuel costs represented a small proportion of the total cost per article or per unit of commodity manufactured.

Considering solid fuel, for instance, the following operations were necessary in most of its industrial applications, representing collectively quite a fair

proportion of the production costs: (1) Handling of the fuel direct to plant or alternatively into storage. (2) Handling of fuel into furnaces or boilers. (3) Reclaiming fuel from storage for use in the plant. (4) Cleaning the firebed if hand-firing is used. (5) Disposing of uncombustible refuse from the furnaces or boilers. (6) The ground occupied by the fuel consuming plant and the fuel storage costs per annum a definite amount in rates and contributes to the overhead costs.

Using liquid fuels, these auxiliary costs were reduced to a great extent as the handling of the fuel was confined to pumps and pipe lines. Storage tanks were necessary for the provision of an adequate supply of fuel and in some cases there was an additional cost for heating coils of steam piping to keep the oil at the desired viscosity. Towns gas, however, suffered from few of these disadvantages as it was supplied at a practically constant pressure and calorific value and the delivery to the furnace was very often accomplished by "mains" pressure. The storage of the gas was carried out in the gas holders of the supply authorities.

The next consideration in the choice of a fuel was the "flexibility" or ease of control possible with it. The disadvantages of the solid fuels in this respect were obvious and the "intermittent process" where definite amounts of heat had to be transferred in definite periods of time was impossible of efficient operation with solid fuels. Liquid fuels were much more easily controlled by a simple system of valves or thermostats but the "cut-off" of a stream of liquid was not so instantaneous as might be desired.

The ease of control, by direct-acting bi-metallic or pressure thermostats, of towns gas was one of its chief advantages and in small-scale plants very often offset a high initial cost per therm. With modern gas-fired apparatus, standby costs were reduced to a minimum and the supply of heat to a plant could be controlled so as to synchronize with the work to an extent not possible with any other fuel.

It had been contended in some quarters that towns gas was too expensive for use in industry on a large scale but generalizations in price were futile considerations and it had to be remembered that where gas was sold at 7d. to 10d. per therm for ordinary use, industries taking comparatively large consumptions had slight difficulty in securing rates which might vary down to 1·5d. or 2·0d. per therm.

The number of industries and processes carried out with towns gas was so immense that the lecturer decided to select a few applications, some of which were actually in use and others which were being experimented with.

One problem handled had been the preheating of mill rolls for the production of tinplates, black sheets, and galvanized sheets. The process briefly was to preheat the rolls to the required working temperature before starting a mill up on a Monday morning after shutting down for a week-end. It was essential that any form of preheating should result in a very even surface temperature over the roll as excessive temperature variations might produce stresses sufficient to shorten the effective life of the roll. The apparatus adopted consisted of a light mild steel sheet hood which was welded in two halves with the joints coming centrally above the top roll and below the bottom roll. The hood was made to conform to the shape of the two rolls and had an air space of approximately 3 in. around the surface of both rolls except at the "sup" where this was reduced to approximately 2 in. The inside of the hood was lagged with ½-in. asbestos sheets and the gas burners were made of ⅜-in. diam. steel nipples just breaking through the asbestos lining. Passing through the steel outer sheet the nipples were screwed into pipe rails running parallel with the rolls and further connected to four gas and air injectors and mixers. Each of these injectors supplied about 60 burners and heated one half of each roll. The results of extensive tests proved that the maximum temperature difference between any two points on the surface of the rolls was not more than 3° to 6° C., being approx. 1—2% at 350° C. working temperature. The use of gas for this purpose was in every way an improvement on the old methods of warming the rolls with wasted plates. The consumption of gas was approximately 2000—2500 cb. ft. for two 24-in. diam. rolls 28 in. long and the time taken to heat up about 5—6 hours. In addition, the rolls did not require to be rotated during heating.

In certain cases, where a supply of gas was available at competitive prices, annealing furnaces could be converted to gas-firing with very satisfactory results. The chemical nature of the "atmosphere" present in the furnace had an important effect on the quality of the work put through it. With towns gas as a fuel, an oxidizing, neutral, or reducing atmosphere could be obtained in a furnace at will by simple adjustment of the gas and air mixture. The control of temperature was an important point in most metallurgical operations, especially when expensive alloy steels and non-ferrous alloys were used. These alloys were extremely susceptible to temperature changes around their critical points, and their test properties were influenced enormously by their heat treatment before and after working. The ease of control possible with towns gas had been due to a considerable extent to the effective manner in which automatic devices could be applied to operate.

Gas-fired steam and hot water boilers were finding extensive use in chemical industries at the present time and the past few years had seen immense progress in the design and construction of these from 100,000 B.Th.U. per hour up to 40 and 50 million B.Th.U. per hour. Steam and hot water were used together or separately in a host of industries including breweries, laundries, the food trades, polish making, dyeing, the textile industries, and in various chemical industries for distillation and evaporation. The use of gas for generating steam and hot water had been gradually increasing in the smaller industries and the domestic field. Its use on a large scale for generating steam in quantities of 10,000 lb. per hour and upwards had been largely retarded by two difficulties; firstly, the price offered by undertakings for this type of load was not low enough to compete with other fuels and secondly, tubular boilers as applied to coal and oil fuels were not capable of working at continuous high efficiencies with gaseous fuels. The high cost per therm of towns gas necessitated its combustion with extremely high efficiency

over long periods if it was to compete with lower-priced fuels.

The latest development in gas-fired steam boilers was that introduced by Messrs. Autocontrol Boilers, embodying the Vesta system of gaseous combustion. The essential features of this process were the conversion of approximately 75% of the available heat in the gas into radiant heat in the combustion chamber which was entirely water cooled and the automatic control of the steam pressure which ensured the thermal efficiency of the boiler being practically unaffected by such extreme conditions as a drop to 10% of the rated load, and an increase of 100% above the rated output. The gas was burned from a number of burners into a refractory bed which attained a temperature of about 3800° F. The system was controlled by an electric motor-driven fan.

The conversion of the available heat into radiant heat considerably reduced the size of the boiler, as the combustion chamber space was reduced to the absolute minimum. Also the heat transfer could be increased to over twice those obtainable in present boilers, with the result that considerable economies could be effected in the initial cost of the boiler by reason of its reduced size.

The addition of economizers to the latest designs of Vesta boilers gave thermal efficiencies of 90% under varying outputs. The waste gas temperatures in Vesta steam boilers rarely exceeded 30 to 40° F. above the steam temperature at the end of their traverse through the boiler. The Vesta hot water boiler was constructed of alloy cast iron to withstand high temperatures and corrosive atmospheres. The controlling equipment was similar to that of the steam boiler with the exception that the return water temperature actuated the thermostat. The lower temperatures required in water as compared with a steam boiler resulted in considerably higher efficiencies being obtained on these boilers. It was evident that the application of towns gas to the heating of liquids had reached a state of perfection which rendered its use in chemical industries desirable from the viewpoint of efficiency and economy. The generation of mechanical or electrical power is another operation of importance to the chemical industries. In some processes the amount of power required in the plant was greater than the amount of low-temperature heat used in the process, and the use of high-powered gas engines with waste heat-recovery plants had several decided advantages over systems of generating separate power and process heat. One of the best-known types of high-power gas engines was the "Vurnberg" manufactured by Messrs. Maschinen-fabrik Augsburg-Nurnberg A.-G. These engineers developed the large gas engine primarily for use with coke-oven and blast-furnace gas, and the standard engine has been widely used for electricity production, gas compressing and boosting on the Continent and elsewhere. This was usually a double-acting tandem engine with automatic mixture controls and in the larger sizes compressed air operated valves. Supercharging and scavenging was carried out on some classes of engines and the overall thermal efficiencies of several installations compared very favourably with Diesel engines. Recent developments in the design of these gas engines had culminated in a new vertical engine running at fairly high speeds and developing over 1000 b.h.p. per cylinder.

The use of the heat in the exhaust gases for the supply of process steam etc. had been co-ordinated in the M.A.N. engines with the recovery of heat from the cooling water. Steam was generated in the cooling jackets and the water, saturated with steam bubbles, rose into a steam drum above the engine where the water circulated back to the jackets. Active circulation was obtained without a pump and from 0·85 to 1·3 lb. of steam per b.h.p. at 85 lb. per sq. in. pressure (according to the size and type of engine) was obtained.

The lecturer stated that he had given no comparative figures for the running costs of gas and competitive fuels in different industries, his reason for not doing so being that the local conditions appertaining in different works manufacturing similar products varied so much in methods, environment, and the sequence of processes employed. It was obvious that in specific cases under certain conditions of working the use of towns gas for various processes might exercise considerable reductions in the overall production costs while in another works the conditions might render difference between solid and gaseous fuel costs of little importance in relation to the total cost of the product.

In the long and animated discussion which followed, it was evident that the subject was one of intense interest to the fuel industries in South Wales. Amongst those who contributed to the discussion were Mr. Thornton (Skewen), Mr. Hicks (Treforest), and Mr. Watts (Cardiff). The meeting closed with a vote of thanks to Mr. Cruise for his paper, and an expression of regret that he had been unable to be present.

CHEMICAL SOCIETY

An ordinary scientific meeting was held on February 2, Prof. J. C. Philip, O.B.E., F.R.S., occupying the chair.

Dr. F. M. Hamer discussed :

Tricarbocyanines. [With N. I. Fisher.]

The tricarbocyanines are cyanine dyes of a new class, in which the two heterocyclic nuclei containing nitrogen are linked by the seven-carbon chain, :CH·CH:CH·CH:CH·CH:CH. They are photographic sensitisers, and their discovery has made it possible to photograph further into the infra-red than ever before. Two methods of preparation from heterocyclic ammonium salts containing a reactive methyl group are described. The first consists in adding an alcoholic solution of such a salt to one of 2:4-dinitrophenylpyridinium chloride, which has been previously treated with alkali so as to liberate glutaconic aldehyde. The second, and better, method comprises heating an alcoholic solution of the ammonium salt with glutaconic aldehyde dianilide hydrochloride, in the presence of alkali. There have been prepared *thio-*, *thiazolino-*, *seleno-*, and 2:2-*tricarbocyanines*. The methods gave negative results in the cases of thiazolo-, oxa-, indo-, and 4:4′-tricarbocyanines, but an *indotricarbocyanine* could be obtained by condensing a substituted indoleninium salt with the

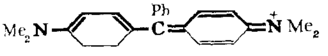
dianilide in acetic anhydride solution, in the presence of sodium acetate. The tricarbocyanines have lower melting points than the corresponding carbocyanines and are relatively more unstable to heat and light. The maximum of the sharply defined absorption band of a tricarbocyanine lies 190—205 μμ nearer to the red end of the spectrum than does the absorption maximum of the corresponding carbocyanine.

Dr. W. H. Mills referred to the interest of the tricarbocyanines in connexion with the relation between colour and chemical constitution. When a cyanine molecule absorbs light energy, this energy is consumed in raising an electron from its ground state to an excited level. It is by the transference of the energy thus stored in the excited cyanine molecule to a silver halide molecule that photo-sensitisation is brought about. The atomic grouping essential to the colour of the cyanine dyes consists of a chain of conjugated unsaturated linkings uniting a tertiary to a quaternary nitrogen atom (I):

$$-N-C=C-(-C=C)_n-C=\overset{+}{N}- \quad \ldots \quad (I)$$

$$\overset{-}{O}-C=C-(-C=C-)_n-C=O \quad \ldots \quad (II)$$

An analogous grouping is to be found in most basic dyes, *e.g.*, in malachite green (III).



(III)

The existence of corresponding pairs of basic and hydroxylic dyes, *e.g.*, rosaniline and rosolic acid, shows that the grouping II is also one which gives rise to intense colour. In this, the conjugated chain links two oxygen atoms, one doubly bound, the other singly bound and bearing a negative ionic charge. Any explanation must be applicable to both the systems I and II, each of which is a tautomeric system with a strong potential gradient falling from right to left.

The presence of a conjugated chain, even in hydrocarbons, always causes specific absorption; and lengthening of the chain, as here in the cyanine dyes, always causes the absorption bands to shift towards the infra-red. Assuming the electron excited to be a valency electron of the conjugated chain, this means that each increase in the length of the chain brings about a diminution in the energy difference between the ground state and the first excited level of this electron. The colour cannot be referred to oscillation of the systems between their two tautomeric arrangements.

Mr. O. F. Bloch expressed the hope that physical chemists would take up the problem of the mechanism of optical sensitising, about which very little is known. The optimum amount of dye required is very small—in the case of one infra-red sensitiser only 1 g.-mol. of dye being necessary for 374,000 g.-mol. of silver halide. Small changes in the substituent groupings, *e.g.*, the change from Me_2 to Et_2, are able to produce very great differences in the sensitising power of the same dye, although the absorption spectrum may remain unchanged. A number of other facts are well established, but rational explanations are still lacking.

Prof. J. T. Hewitt asked whether dyes with different terminal groups had been prepared, and if so, how such asymmetrical dyes compared with those described in regard to sensitisation.

Dr. Hamer replied that unsymmetrical carbocyanines had been prepared by Imperial Chemical Industries, Ltd. (Piggott and Rodd). Some are sensitisers, but it is impossible to predict which will be good sensitisers. The authors had failed to prepare unsymmetrical tricarbocyanines. They had also unsuccessfully tried to make tricarbocyanines carrying a hydroxyl group on one carbon atom of the chain by means of the hydroxyglutaconic aldehyde derivative which König had prepared from furfuraldehyde.

Dr. S. O. Rawling said that there is abundant evidence that the absorption of a dye is closely related to the spectral region of its sensitising action. The absorption of light energy is said to result in the "excitation of electrons," but we still desired to know in what part of the molecule the light is absorbed, and what occurs after or during the process of absorption when the dye is attached to a crystal of silver halide.

Mr. T. W. J. Taylor discussed:

The Configurations of the Aldoximes from Measurements of Electric Dipole Moment. [T. W. J. Taylor and L. E. Sutton.] See J.C.S., 1933, 63.

Dr. O. L. Brady said that the problem of the configuration of alkyl ethers of aldoximes could be solved only by a physical method; the matter had now been settled by the authors' experiments. He believed that in the case studied inversion had not occurred during alkylation, but he could not agree that in every case an aldoxime would not suffer inversion of configuration during alkylation. The behaviour of aldoximes, in contrast to that of ketoximes, is often abnormal in this respect.

Prof. J. I. O. Masson discussed:

A Mode of Studying Nitration. [J. A. Hetherington and J. I. O. Masson.] See J.C.S., 1933, 105.

Dr. N. V. Sidgwick referred to the analogous case of the sulphonation of benzene, which ceases at a particular $H_2SO_4 : H_2O$ ratio.

Prof. R. Robinson said that it had occasionally seemed a matter for regret that so much attention had been paid to nitration in orientation studies and so little to other types of substitution reactions. Work like that now described, however, would enable us to put our accumulated data to better use; all chemists interested in the mechanism of aromatic substitution would be grateful that these fundamental investigations had been initiated. It would be expected, *a priori*, that $PhNO_2$ should nitrate mainly *meta* and $PhNO_2H^+$ exclusively *meta*, the former reaction being much the more rapid. The evidence for the theory that $PhNO_2$ in H_2SO_4 nitrates through the stage $PhNO_2H^+\}HSO_4^-$ is not yet convincing, and is opposed to preconceptions based on consideration of a range of nitrations from PhO^- (very rapid) to $PhNMe_3^+$ (very slow).

Prof. A. J. Allmand said that it is rather curious that the reaction between bromine and benzene in the

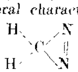
dark also appears to stop at about 50% transformation. This has been observed by Schramm and confirmed by others. *Neither a reverse reaction between HBr and* C_6H_5Br, *nor the formation of a molecular compound* $C_6H_5Br.C_6H_6$ which is not subject to dark bromination, seemed an adequate explanation.

Dr. A. D. Mitchell suggested the possibility of inhibition by HBr_3 in the case quoted by Prof. Allmand.

Prof. Masson, replying, said that with regard to the relative speeds of nitration of anions and cation, presumably one should discriminate between *ortho-para* nitration of the former and *meta* nitration of the latter. Until further work is done on the variation of the proportion of *m-* to *o-p-*products in the reaction covered by the paper, it seemed difficult directly to test Prof. Robinson's criticism.

Dr. R. G. W. Norrish discussed:

Primary Photochemical Processes. II. The Absorption Spectrum and Photochemical Decomposition of Diazomethane. [With F. W. Kirkbride.]

(1) The absorption spectrum of diazomethane vapour has been investigated, and two absorption regions have been found: the first, from 4710 Å. to 3200 Å., consists of diffuse bands followed by a continuum, while the second, beginning at 2650 Å., is completely continuous. *The general character of the spectrum supports the* formula  for diazomethane.

(2) The photochemical decomposition of diazomethane has been found to be a kinetically unimolecular reaction in which the main products are nitrogen, ethylene, propylene, and a non-volatile liquid which is possibly a pyrazoline derivative. The quantum efficiency is of the order 4 both at 365 mμ and at 436 mμ.

(3) From the above facts and from the photochemical behaviour of mixtures of diazomethane with hydrogen and with oxygen, it is concluded that the primary process in the photochemical decomposition is $CH_2N_2 + h\nu = CH_2 + N_2$. The formation of the actual reaction products is readily explained in terms of secondary processes following on this.

Prof. A. J. Allmand said that there is now evidence indicating that the simple interpretations put forward a few years ago of the chemical effects following absorption in banded diffuse and continuous spectra must be somewhat modified in practice. He agreed with Dr. Norrish's general interpretation of his results.

Dr. J. G. A. Griffiths said that the authors had already shown that the photo-excitation of compounds of the type CRR' : O leads to the simultaneous rupture of the C·R and C·R' linkings, and they have now described another case of this general type of primary photoreaction. In the homogeneous thermal decomposition of methane at 700—1000° (Kassel, J. Amer. Chem. Soc., 1932, 3949; Ruedy, Canad. J. Res., 1932, 328) strong evidence is adduced that the primary reaction is $CH_4 \rightarrow CH_2 + H_2$ rather than $CH_4 \rightarrow CH_3 + H$, and thus thermal activation of a molecule can also lead to the almost simultaneous rupture of two C·H linkings. It is suggested that the simultaneous rupture of the two linkings between three atoms may be a more general phenomenon than has been hitherto supposed.

Mr. E. J. Bowen said that in a recent paper Franck, Sponer, and Teller remove many of the difficulties of interpreting the phenomenon of predissociation of *polyatomic* molecules, but only at the cost of abandoning the original clear-cut conception of predissociation involving the splitting of one link only and occurring at a spectral limit which can be equated to the heat of dissociation. The authors' results on diazomethane and on formaldehyde seem easily explicable on this basis.

Dr. Norrish, replying to Dr. Goodeve, said that the only gases added were oxygen and hydrogen, and the products confirmed the presence of the CH_2 : radical in the decomposition. The thermal reaction occurs practically quantitatively by a bimolecular reaction at about 200° to give one volume of nitrogen and a half volume of ethylene. Above a certain pressure limit it passes over into an explosion. The simple products, and bimolecular kinetics, suggest that we are here dealing with activated molecules, explosion occurring by a branching energy chain in consequence of the high exothermic character of the reaction. The photochemical change is more complex, and the diverse products are most satisfactorily explained by the liberation of free CH : radicals. Further, the character of the absorption spectrum, which is altogether devoid of fine structure, is characteristic of dissociation and not of activation.

On these grounds the authors feel confident that the main photochemical process is one of dissociation rather than of activation. The speaker agreed with Prof. Allmand and Mr. Bowen that the spectroscopist's *interpretation of molecular spectra* will probably be much modified as more accurate data, particularly on the chemical side, appear. It is certain that our knowledge of primary photochemical reactions is at present all too sparse to provide an adequate check on spectroscopic theory, and the present series of studies had been taken up in the hope of remedying the deficiency in some measure.

Ostwald Memorial Lecture

On January 27, at the University of Liverpool, the Ostwald Memorial Lecture was delivered by Prof. F. G. Donnan, C.B.E., F.R.S. Prof. E. C. C. Baly, C.B.E., F.R.S., presided.

The following is a summary of Prof. Donnan's address:

Wilhelm Ostwald was born at Riga on September 2, 1853, and was descended from pure German stock that had settled in the Baltic Province of Livland. He was sent to school at the *Realgymnasium* of Riga, where in his 19th year he passed the necessary examination admitting him to Dorpat University as a student of science. In 1875 he passed the *Candidat* examination, presenting a short thesis on the mass action of water (hydrolysis of dissolved bismuth chloride).

Ostwald now embarked on the long series of researches that were to bring him fame, namely, various experimental methods of determining the relative "strengths" or "affinity coefficients" of acids (and bases) in aqueous solutions. In his *Volume-Chemical Studies*, he followed

the method of Julius Thomsen, which consisted in ascertaining the distribution of a base between two competing acids, but instead of measuring heat effects he determined changes in density. The *Volume-Chemical Studies* were followed by a series of *Chemical Affinity Measurements*, in which the dissolving effect of acids on a series of slightly soluble salts were investigated. These researches obtained for Ostwald the degrees of Master and Doctor of the University of Dorpat. In 1882 he was called to the Professorship of Chemistry at the Riga Polytechnikum, where he carried out a long series of investigations entitled *Studies on Chemical Dynamics*. In this work he measured the effect of acids on the velocity of hydrolysis of acetamide, methyl acetate, and cane sugar, and on the rate of oxidation-reduction reactions.

All these different methods gave Ostwald a series of characteristic values for the affinity-coefficients of the acids. The early and important work of Arrhenius led him into the field of electrical conductivity, with the result that he soon found that comparable values for the molecular or equivalent conductivities of the acids in aqueous solution were nearly proportional to his relative affinity-coefficients determined by chemical means. Ostwald and Arrhenius were now on the verge of the theory of electrolytic dissociation, *i.e.*, the ionisation of acids, bases, and salts in solution.

In 1887 Ostwald was called to the Chair of Physical Chemistry at Leipzig University. He now took up with enthusiasm the new field opened up by van't Hoff's osmotic theory of solutions and Arrhenius' theory of ionisation, and soon created at Leipzig a world centre for the study and investigation of the new physical chemistry. In 1897 a new physico-chemical Institute was built for him. Students flocked to his laboratory from all parts of the world. Ostwald's success in creating and organising the science of general and physical chemistry was due as much to his incessant literary labours as to the researches of himself and his students. In 1887 he founded the *Zeitschrift für physikalische Chemie*, which he edited for many years; whilst in a long series of books he expounded and made known the facts and principles of the science—the great *Lehrbuch der allgemeinen Chemie*, the *Grundriss der allgemeinen Chemie*, the *Hand und Hilfsbuch physiko-chemischer Messungen*, the *Wissenschaftliche Grundlagen der analytischen Chemie*, the *Grundriss der anorganischen Chemie*, etc.

In 1906 Ostwald retired from University work at the early age of 53, and devoted himself to developing his *Energetik*, the concept of phenomena as due to the interplay and interaction of energy in different forms; his *Naturphilosophie*, a philosophy of science which was to be a "Science of the Sciences"; and various schemes and movements, national and international, for the better organisation of intellectual work and human culture.

During the war and afterwards he threw himself with youthful vigour into the investigation of the practical measurement and standardisation of body colours. In the closing years of his life he wrote his famous autobiography in 3 volumes, the *Lebenslinien*, and studied the laws which determine harmony and therefore beauty in colour and form.

Ostwald was made an Honorary Fellow of the Chemical Society, and became a foreign (honorary) member of most of the great academies and societies of science throughout the world. In 1909 he received the Nobel Prize in Chemistry for his researches on catalysis.

He was very happy in his family life and is survived by his wife, two daughters, and three sons, one of whom, Wolfgang, is Professor at Leipzig University and famous for his researches in Colloid Chemistry and the foundation of the *Kolloid Zeitschrift*, which he edits, and the *Kolloid Gesellschaft*.

Wilhelm Ostwald will long be remembered as the man who by his personal investigations and those of the men he inspired, his writing of books and foundation and editing of Journals, and his excellent organising talents, so expounded and focussed the work of investigators in general and physical chemistry that he became the real founder and the first great exponent of this branch of science.

MIDLANDS CHEMISTS' DINNER

The annual dinner, followed by a dance, arranged by the Midland Chemists' Committee, representing the Birmingham and Midland Sections of the Society of Chemical Industry, Institute of Chemistry, and the British Association of Chemists, took place on Saturday last at the Midland Hotel, Birmingham, and was largely attended. Mr. W. A. S. Calder presided, supported by the President of the Society of Chemical Industry (Dr. R. H. Pickard, F.R.S., Director of the Cotton Research Institute, Manchester) and Mrs. Pickard; Mr. H. W. Rowell (chairman of the Birmingham and Midland Section, Society of Chemical Industry); Mr. J. R. Johnson, Dr. E. D. Mason, and Mr. D. W. Parkes (vice-chairmen, Birmingham Section of S.C.I.); Mr. A. W. Knapp, Mr. J. C. Mann, Dr. W. Wardlaw, and Dr. S. R. Carter (Birmingham University); Mr. T. F. E. Rhead, Mr. W. T. Collis, Mr. F. J. Broughall (Chemical Engineering Group); Drs. W. M. Hampton, F. W. Pinkard, A. Slater, C. C. Tanner, R. T. Baillie, Mr. F. R. O'Shaughnessy, Prof. R. H. Hopkins, Mr. E. C. Rossiter, and Mr. George King (honorary secretary).

The toast of "Midland Chemists" was submitted by Dr. Pickard, who gave some interesting reminiscences of his days as an nndergraduate at the old Mason's Science College in Birmingham, from which was established the present University. He paid tribute to the achievements of Tilden, who was at the head of the chemistry department and who of all others first laid the stones which gradually became the path that led into the mysteries of the essential oil industry. Tilden was followed by Percy Frankland, a forceful personality who, on the pure chemical side, taught them to wonder what was the connexion between optical activity and chemical constitution. We are still wondering. The mention of Percy Frankland served to recall the name of one whose work was not sufficiently regarded by the people of this country, namely his father, Edward Frankland. We probably owed more to him for the health of our large cities than to any other man, because Sir Edward Frankland laid down the chemical requirements or specifications of pure water, and the abundance

of pure drinking water was one of the essential achievements of chemical engineering. Percy Frankland not only worked at pure science but extended his distinguished father's work, and there was no doubt that to the Franklands we in this country owed a debt of gratitude. Percy Frankland was followed by Morgan, a versatile man whom he desired on their behalf to congratulate on the honour shortly to be conferred upon him of President of the Chemical Society. We admired the work the professor had done, and we wished him God-speed in his attempts to unravel the chemical mysteries of the carbohydrates which made up so much of our food. Our chemists were not always valued as they ought to be, and Dr. Pickard recalled the fact that very shortly would be celebrated the bicentenary of Priestley, whom Birmingham 150 years ago drove out of the town in a mania of religious persecution.

Dr. Pickard said he thought chemists were to be congratulated on the great change for the better that had taken place in recent years in the estimation by the public of their work: this change was very marked when compared with the position existing in pre-war days. The chemist had come into his own; it was no doubt a slender "own" at times, but there was a great difference in the remuneration that was paid to juniors to-day compared with the amount they received when he started in the profession. He did think however, that as chemists they were suffering a little bit too much from the expectations not only of the public but of business men, as to the achievements of young chemists. There were in addition to the chemists who were engaged in chemical and other industries the research chemist who was employed in almost every industry. He served in an industry which in pre-war days, in two of its sections, never had a scientific man inside the doors. He felt very strongly that in a great many industries which since the war had called in the help of scientific people commercial men were apt to expect too much from them; they wanted to reap returns too quickly. It did not seem to be universally recognized that the scientific man was an individual who had to observe facts. He had to collect the facts, often at great pains, and he could not put forward the results until he was absolutely certain of his ground. There were too many employers who seemed to take the view that it was necessary merely to gather together a few research chemists (paying them none too well) lock them in a room and supply them with apparatus and then expect that within a very short time dividends would come through the door in a constant whirl as a result of their work. "Believe me," said Dr. Pickard, "that does not happen. I would emphasize that the chemist has a very difficult road to hold, and that it takes him some time to do that."

In a facetious response to the toast, which was honoured with enthusiasm, Mr. W. A. S. Calder pointed out that the Midlands had had great chemists in the past, and it also now had distinguished chemists. There were men who were brought up as chemists, but who later forsook the straight and narrow path of science for the broad and primrose way of commerce, but he was glad they never forgot their chemical training, to which of course they owed much of their success. Midland chemists were, he believed, maintaining full the high traditions of their calling.

On the proposition of Mr. H. W. Rowell the health of Mr. George King, who was responsible for carrying out the arrangements for the gathering, was honoured.

The dance followed, and during an interval Mr. King showed a film which he had taken of various important gatherings in connexion with chemical societies.

CORRESPONDENCE

RECOVERY OF ALCOHOL

Sir,—I read your article on the processes at Solvent Products, Ltd. (cf. Chem. & Ind., Feb. 3, p. 98), with great interest, especially as I have recently had the opportunity of seeing in a large French distillery a special method of collection of the gases from open fermentation vats, recovery of the alcohol carried over in these gases, and the production of a purified carbon dioxide, by a very simple process.

This distillery is operating in connexion with a sugar factory and is generally fermenting molasses producing finally absolute alcohol. The recovery of the alcohol is carried out by the use of the "Acticarbone" process and the extra yield of alcohol obtained is considerable. Open vats are in use but the collection of gases is so perfect that the conditions in the factory have been enormously improved, so much so that the room under the vats, before quite useless on account of the accumulation of carbon dioxide in the atmosphere, is now used as a store.

The alcohol, recovered directly by the use of the carbon process, is taken direct to the rectification plant while the impurities in the carbon dioxide are completely removed by the carbon. The gas is led to the sugar factory for carbonating during the sugar extraction season. This could equally well be compressed into cylinders or converted into the solid form after drying.

The point that specially struck me was the simplicity of the process, one small continuous plant carrying out the collection of the gas from 12 large vats, recovery of the alcohol, and purification of the carbon dioxide.

I am, Sir, etc.,

S. Reginald Price

London, E.C.3
Feb. 3, 1933

PERSONAL AND OTHER ITEMS

Mr. L. G. Radcliffe, who is shortly retiring from the position of Lecturer in Organic Chemistry at the Manchester College of Technology, was recently presented by students with an aneroid barometer as a mark of their esteem. Mr. Radcliffe is well known to many members of the Society for the part he has taken in the work of the Manchester Section, and it was the more fitting therefore that the presentation should have been made by Dr. T. Callan, chairman of the Manchester Section.

We regret to record the death on January 29 of Mr. Alfred H. Wiggin, formerly the managing director of Henry Wiggin & Co., the Birmingham firm of metal manufacturers founded by his father. Mr. Wiggin had

also been a director of Elliott's Metal Co., and Muntz's Metal Co., and was a director of the London Midland & Scottish Railway until last December.

We regret to announce the death on January 30 of Mr. G. J. Shave, chief engineer of the London General Omnibus Co. Mr. Shave was a member of the Institution of Mechanical Engineers and also the Institute of Automobile Engineers, and had been connected with the motor industry in this country since 1900.

Dr. J. Mitchell Fain, consulting chemist, is now associated with Foster D. Snell, Inc., 130, Clinton Street, Brooklyn, N.Y. Dr. Snell is well known to members of the Society as the honorary secretary of the American Section.

Institute of Chemistry Annual Dinner

The annual dinner and dance of the Institute is being held on Friday, February 10, at the Empire Restaurant, Wilton Road, Victoria, S.W.1. The date for this event was erroneously given as February 3 in the Calendar of Forthcoming Events of the last issue of CHEMISTRY AND INDUSTRY.

Chemical Society: Announcement

It was announced on February 2 that a meeting of the Society jointly with the University College, Bangor, Chemical Society will be held at Bangor on Friday, March 10, at 5.15 p.m., when Prof. C. S. Gibson, O.B.E., F.R.S., will discuss "The Chemistry of Gold."

Royal Society Mond Laboratory

In the presence of a number of distinguished members of the Royal Society, the Mond Laboratory, which has been provided from the Mond Bequest of the Royal Society, was on February 3 formally presented to the University of Cambridge by Sir F. Gowland Hopkins, P.R.S., and opened by Mr. Stanley Baldwin, as Chancellor of the University. The Laboratory, which has cost about £15,000, has been built and equipped in order to allow Prof. Kapitza, Messel Professor of the Royal Society, to continue his investigations on the properties of matter in intense magnetic fields, begun some 10 years ago in the Cavendish Laboratory. The work of the laboratory will be financed jointly for the next few years by the University and the Department of Scientific and Industrial Research.

Safety in Mines

It is necessary to enclose in flameproof casing any electrical apparatus used in mines in which inflammable gas is likely to occur. Since, however, due to the occurrence of an arc, the liberation of energy might increase the pressure inside the casing, it was thought necessary to ascertain whether the fracture of the casing was likely to result from such an increase in pressure. Particulars of experiments carried out by the Safety in Mines Research Board are now available in S.M.R.B. Paper 77 (H.M.S.O., 6d.). In the experiments electrical power at 720 volts a.c. (1700 amp.), 2000 volts a.c. (190 amp.), and 580 volts d.c. (950 amp.) was used, but within these limits no sudden "pressure pulse" of such character as to cause fracture of the casing was observed on striking an arc. It is of interest to note that arcing between copper electrodes was found generally to result in lower pressures than those from arcing between aluminium.

Organization to Finance Research

At the annual meeting of Lloyds Bank on February 3 the chairman, Mr. J. Beaumont Pease, announced that an organization was being formed to enable industries to finance research work. It was urged that industry must realize that an efficient and well-equipped research organization was an essential element of good management.

Rayon Section of Manchester Chamber of Commerce

Between 60 and 70 representative firms have already become members of the newly-formed Artificial Silk (Rayon) Section of the Manchester Chamber of Commerce, the first meeting of which was held on February 4. Sir Ernest Thompson was unanimously requested to act as chairman until a permanent chairman and committee are elected. The desire was expressed by the meeting that the Section should work in close contact with other interested organizations in Manchester and London.

International Steel Cartel

Following negotiations between the presidents of the steel manufacturers' associations of Germany, France, Belgium and Luxembourg, a decision has been reached to renew the International Steel Cartel for a further five years. Agreement has been reached on the question of production, but the final constitution of the Cartel still remains to be settled, dependent on the attitude of the Belgian producers.

Oil from Coal

"Oil from Coal" is the title of Dr. C. H. Lander's lecture before the Junior Institution of Engineers at 39, Victoria Street, S.W.1, to-day, at 7.30 p.m. A cordial invitation to members of the Society is extended by the Institution.

COMPANY NEWS

SOUTH METROPOLITAN GAS CO.

The report of the company for the year 1932 shows that receipts from the sale of gas were £3,065,004, as compared with £3,216,101 in 1931, and the balance from the revenue account is decreased by £37,317 to £562,609. After provision for debenture interest and other charges the company shows a net profit fo £479,855, an increase over the previons year of £10,234. The directors express satisfaction with the fact that in spite of the industrial depression, receipts from the sale of gas have fallen only to the extent of a little more than 4%. By-products are stated to be continuing in good demand, although the revenue from this source has fallen off.

BRITISH GOODRICH RUBBER CO., LTD.

The company has given notice of the redemption of the 6½% debenture stock on July 31 next. These debentures are redeemable at 105% at any time, following six months notice. The directors have announced that they are considering a proposal for the creation of new debenture stock carrying a lower rate of interest. The amount of stock outstanding at September 30, 1932, was £175,355.

MARKET REPORT

This Market Report is compiled from special information received from the manufacturers concerned.

Unless otherwise stated, the prices quoted below cover fair quantities net and naked at sellers' works.

The following alterations in prices are reported since the publication of the last Market Report (cf. CHEM. & IND., Feb. 3, 1933, p. 109).

RUBBER CHEMICALS

Carbon Tetrachloride.—£42–£47 per ton, according to quantity, drums extra.

Vermilion, pale or deep.—4s. 5d.—4s. 9d. per lb.

PHARMACEUTICAL AND PHOTOGRAPHIC MATERIALS

Acid, Salicylic.—B.P. pulv., 1s. 7d.—1s. 10d. per lb. Technical, 1s. 2d.—1s. 4d. per lb.

Acid, Tannic, B.P.—3s. 9d. per lb.

Phenacetin.—4s.—4s. 6d. per lb.

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific number. *Argentina*: Paint, varnish, chemical products (199). *Australia*: Synthetic resins (154); Bi-carbonate of soda, industrial lactic acid (157). *Beirut (Syria)*: Cellulose paint (190). *Belgium*: Fine chemicals, pharmaceutical products (177). *British West Indies*: Paint (160). *France*: Chemicals for manufacture of pharmaceutical products (179). *Harbin (Manchuria)*: Ferro-silicon (191). *United States*: Tinplate (197).

Dyestuffs (Import Regulation) Act, 1920

The following statement relating to applications for licences under the Dyestuffs (Import Regulation) Act, 1920, made during January, has been furnished to the Board of Trade by the Dyestuffs Advisory Licensing Committee. The total number of applications received during the month was 518, of which 455 were from merchants or importers. To these should be added 2 cases outstanding on December 31, making a total for the month of 520. These were dealt with as follows: Granted—509 (of which 505 were dealt with within 7 days of receipt); referred to British makers of similar products—5 (all dealt with within 7 days of receipt); outstanding on January 31—6. Of the total of 520 applications received, 510, or 98%, were dealt with within 7 days of receipt.

Import Duties Advisory Committee

The Import Duties Advisory Committee gives notice of the applications for the addition to the Free List of wax matrices and copper matrices of gramophone records.

Representations regarding these applications should be addressed in writing to the Secretary, Import Duties Advisory Committee, Caxton House, Tothill Street, S.W.1, not later than February 20, 1933.

New I.C.I. Dyestuffs

Imperial Chemical Industries Ltd. has issued further pattern cards dealing with four new additions to its range of dyestuffs.

Rodamine 6GBS is of considerable interest to . branches of the textile dyeing and printing shades. can be employed for dyeing paper, coir, wood chip a allied fibres, for colouring soaps, for the manufactu of lakes for use in the printing ink and paper surfaci trades, and for wood stains, aerographic work et The pattern card illustrates the attractive effect obtaine with tannin mordanted yarn, spun silk, and woollen yar and an example is given of a tannin discharge print o direct dyed ground.

Monolite Rubine 4BS Paste represents the bluest (the Monolite colours and is eminently suitable for th production of high grade printing inks, whilst it is fast t varnishing, and when used as a calcium lake is charac terized by its brilliance and extreme blueness of unde tone. It will find use also for the manufacture of o and water-paints, for wallpapers, and for non-bleedin cellulose lacquers possessing good fastness to light.

Monolite Red 4RHS is an insoluble pigment dyestu particularly suited to the production of high cla printing inks, cellulose enamels, water paints and di tempers. Its fastness to light and alkali make it ver suitable for the manufacture of ink for soap wrappe printing, and it will find use also for linoleum, cemen compositions and mural decorations.

Solochrome Black RNC 50 is similar, but slightl superior in washing and milling fastness, to Solochrom Black RN and is specially recommended for the produ tion of full blacks on worsted piece goods containin cotton or viscose effects which are to be reserved. Th pattern card shows examples of such dyed worsted with cotton and viscose effect threads left undyed.

PUBLICATIONS RECEIVED

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TRAITÉ DE CHIMIE MINÉRALE. By Prof. P. Pascal. Vol XI. MOLYBDÈNE-TUNGSTÈNE-URANIUM-THORIUM MÉTAU DE LA FAMILLE DU PLATINE. By C. Boulanger, R Charonnat, M. Delépine, C. Duval, R. Flatt, L. Mala prade, P. Poulenc, A. Travers. Pp. xxiii + 836 Paris: Masson et Cie, 1932. 155 fr.

TABLES ANNUELLES DE CONSTANTES ET DONNÉE NUMÉRIQUES DE CHIMIE, DE PHYSIQUE, DE BIOLOGIE E DE TECHNOLOGIE. Published under the patronage o the International Union of Pure and Applie Chemistry. Tables des Matières. Vol. IX, 1929 Pp. xxiv + 124. Paris: Gauthier-Villars et Cie; Ne York: McGraw-Hill Book Co., 1932.

FILME UND FÄDEN. (IX. VERHANDLUNGSBERICHT DE KOLLOID-GESELLSCHAFT, HAUPT-VORTRÄGE GEHALTE AUF DER IX. HAUPTVERSAMMLUNG DER KOLLOID GESELLSCHAFT IN MAINZ VOM 28—30. SEPTEMBER 1932.) Edited by Prof. Dr. W. Ostwald. Vol. LXI Part 2. Pp. 129—312. Dresden and Leipzig: T Steinkopff, 1932. 12 rm.

MANIPULATIONS DE CHIMIE. By C. Duval. Pp. vi + 375. Paris: Masson et Cie, 1933. 65 fr.

BRITISH JOURNAL PHOTOGRAPHIC ALMANAC, 1933. Pp 656. London: Henry Greenwood & Co., 1933. 2s. (paper covers); 3s. (cloth bound).